Attorney's Docket: 13076-002001 / AAMOSP01

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Bruce Radl
Serial No. : 09/966,484
Filed : September 28, 2001
Title : IMAGING WITH SPECTRALLY DISPERSIVE ELEMENT FOR ALIASING REDUCING

Art Unit : 2612
Examiner : Matthew L. Rosendale

Mail Stop Appeal Brief - Patents
Hon. Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

BRIEF FOR APPELLANT

(1) REAL PARTY IN INTEREST

Not applicable.

(2) RELATED APPEALS AND INTERFERENCES

None.

(3) STATUS OF CLAIMS

Claim 7 is allowed, and appealed claims 1-6, 8 and 9 stand rejected under 35 U.S.C. §102(b) as anticipated by Langworthy.

(4) STATUS OF AMENDMENTS

A response filed 13 February 2004 was entered.

(5) SUMMARY OF INVENTION

The invention comprises electro-optical apparatus including lens apparatus, such as 11, a CCD image sensor having a predetermined filter pattern of color sensitive pixels, such as 13, and

a spectrally dispersive element, such as 12, between the lens apparatus and the CCD. The filter pattern may be a Bayer filter pattern (FIG. 1) or a tri-stripe filter pattern (FIG. 6). The color-sensitive pixels may be arranged in contiguous groups with each group having at least a red pixel and a blue pixel with the spectrally dispersive element and lens apparatus constructed and arranged to focus a line image of an optical point upon a line of a group with the red end of the line within the red pixel of a group and the blue end of the line within the blue pixel of the group, such as 11B, in FIG. 3. Each group may comprise a square having the red pixel adjacent to first and second green pixels adjacent to a blue pixel, such as 13 shown in FIG. 3. The lens apparatus and spectrally dispersive element may be constructed and arranged so that red and blue images are optically shifted to coincide geometrically at a point on the CCD, such as 11B.

A method of optical processing according to the invention includes focusing the image of an object upon a photoelectric array, such as 13, with a spectrally dispersive element, such as 12, between the lens, such as 11, and the array, such as 13, and may further include optically shifting red and blue digital images of the object to coincide geometrically on the array, such as 11B. Page 2, lines 7-21; page 3, lines 10-31.

(6) ISSUES

1. Whether Langworthy anticipates claims 1-6, 8 and 9, when the reference fails to disclose each and every element arranged as in the claims.

2. Whether claim 4 is independently patentable over the reference when the reference fails to disclose structures configured to focus a line image of an optical point or suggest the desirability of modifying what is there disclosed to meet this limitation.

(7) GROUPING OF CLAIMS

Claim 4 is independently patentable, and Appellant explains why claim 4 is believed to be separately patentable below.

(8) ARGUMENT

I. THE FOUR ELEMENTS 72, 74, 76 AND 78 IN THE REFERENCE ARE NOT A SINGLE SPECTRALLY DISPERSIVE ELEMENT AS CALLED FOR BY ALL THE CLAIMS; THEREFORE, LANGWORTHY CANNOT ANTICIPATE THE REJECTED CLAIMS.

"It is well settled that anticipation under 35 U.S.C. 102 requires the presence in a single reference of all of the elements of a claimed invention." *Ex parte Chopra*, 229 U.S.P.Q. 230, 231 (BPA&I 1985) and cases cited.

"Anticipation requires the presence in a single prior art disclosure of all elements of a claimed invention arranged as in the claim." *Connell v. Sears, Roebuck & Co.*, 220 U.S.P.Q. 193, 198 (Fed. Cir. 1983).

"This court has repeatedly stated that the defense of lack of novelty (i.e., 'anticipation') can only be established by a single prior art reference which discloses each and every element of the claimed invention." *Structural Rubber Prod. Co. v. Park Rubber Co.*, 223 U.S.P.Q. 1264, 1270 (Fed. Cir. 1984), citing five prior Federal Circuit decisions since 1983 including *Connell.*

In a later analogous case the Court of Appeals for the Federal Circuit again applied this rule in reversing a denial of a motion for judgment n.o.v. after a jury finding that claims were anticipated. *Jamesbury Corp. v. Litton Industrial Prod., Inc.*, 225 U.S.P.Q. 253 (Fed. Cir. 1985).

After quoting from *Connell*, "Anticipation requires the presence in a single prior art disclosure of all elements of a claimed invention arranged as in the claim," 225 U.S.P.Q. at 256, the court observed that the patentee accomplished a constant tight contact in a ball valve by a lip on the seal or ring which interferes with the placement of the ball. The lip protruded into the area where the ball will be placed and was thus deflected after the ball was assembled into the valve. Because of this constant pressure, the patented valve was described as providing a particularly good seal when regulating a low pressure stream. The court quoted with approval from a 1967 Court of Claims decision adopting the opinion of then Commissioner and later Judge Donald E. Lane:

> [T]he term "engaging the ball" recited in claims 7 and 8 means that the lip contacts the ball with sufficient force to provide a fluid tight seal. *** The Saunders flange or lip only sealingly engages the ball 1 on the upstream side when the fluid pressure forces the lip against the ball and never sealingly engages

> the ball on the downstream side because there is no fluid pressure there to force the lip against the ball. The Saunders sealing ring provides a compression type of seal which depends upon the ball pressing into the material of the ring. *** The seal of Saunders depends primarily on the contact between the ball and the body of the sealing ring, and the flange or lip sealingly contacts the ball on the upstream side when the fluid pressure increases. 225 U.S.P.Q. at 258.

Relying on *Jamesbury*, the ITC said, "Anticipation requires looking at a reference, and comparing the disclosure of the reference with the claims of the patent in suit. A claimed device is anticipated if a single prior art reference discloses all the elements of the claimed invention as arranged in the claim." *In re Certain Floppy Disk Drives and Components Thereof*, 227 U.S.P.Q. 982, 985 (U.S. ITC 1985).

The final action states:

> 1. Referring to claim 1, Langworthy discloses an electro-optical apparatus in figure 13 comprising a lens 10, a CCD image sensor 20 having a pattern of color sensitive pixels, and a spectrally dispersive element comprising dichroic mirrors 72, 74, 76, and 78 between the lens 10 and CCD 20 (Col. 6, Lines 6-34).
> 2. Referring to claim 2, Langworthy discloses a Bayer filter pattern as shown in figure 14.
> 3. Referring to claim 3, Langworthy discloses an alternative embodiment where the color filter pattern is a tri-stripe shown in figures 7 and 8.
> 4. Referring to claim 4, Langworthy discloses color-sensitive pixels arranged in continuous groups having a red pixel and a blue pixel as shown in figure 14. The spectrally dispersive element 72, 74, 76, and 78, and the lens 10 shown in figure 13 are configured to focus a line image of an optical point by optically shifting object light upon a line of a group with the red end of the line within the red pixel and the blue end of the line within the blue pixel (Col. 6, Lines 6-34).
> 5. Referring to claim 5, Langworthy discloses a Bayer pattern shown in figure 14 having continuous 2x2 pixel groups having a red pixel adjacent to a first and second green pixels adjacent to a blue pixel.
> 6. Referring to claim 6, Langworthy discloses a spectrally dispersive element comprising dichroic mirrors arranged so that red and blue images are optically shifted to coincide geometrically at a point on the CCD image sensor (Col. 6, Lines 6-34).

> 7. Referring to claim 8, Langworthy discloses a method of optical processing by focusing an image upon a CCD with a spectrally dispersive element between the lens 10 and array 20 shown in figure 13 (Col. 6, Lines 6-34).
> 8. Referring to claim 9, Langworthy discloses a method of optically shifting red and blue images to coincide geometrically at on the sensor array as shown in figure 13 (Col. 6, Lines 6-34). Pp. 3-4.
>
> According to Webster's Dictionary, the term "disperse" is defined as, "to cause to break up" and the term "spectrum" is defined as, "a continuum of color formed when a beam of white light is dispersed so that its component wavelengths are arranged in order". As shown in figure 13 of Langworthy, a series of dichroic mirrors 72, 74, 76, and 78 are provided to receive a beam of white light from the taking lens 10 and disperse the component wavelengths of the light in order of Red, Green, and Blue. P. 2.

A basic fallacy in the final rejection is treating the four elements 72, 74, 76 and 78 as a single dispersive element called for by all the rejected claims.

As the Federal Circuit Court of Appeals recently said in *Summit Technology, Inc., v. Nidek Co., Ltd.*, (No. 03-1214, March 26, 2004):

> ...Essentially, Summit argues that Nidek's device literally infringes because in the accused device, a series of pulses across the cornea are physically combined and cover "the entire area of the cornea one wishes to operate upon." But the claim language requires the formation of "a light spot ... the area of said light spot having a maximum area at least as large as the area of the cornea desired to be operated upon." Azema '330 patent, col. 11, ll. 29-33 (emphasis added). Thus, Summit must establish that Nidek's device is capable of creating a single light spot, the maximum area of which is "at least as large as the area of the cornea desired to be operated upon." (Slip. op. 2.18.)

Here, the claim language requires "a dispersive element."

Consider the following definitions: Element: 1. A fundamental, essential or irreducible constituent of a composite entity. The American Heritage Dictionary of the English Language (4th Ed. 2000 Houghton Mifflin Company).

Optical definition: Element: A lens, window, mirror, prism, wedge, or other unit, usually made of glass, that is used in an optical instrument to control light. Practical Optics (1983 IMP).

Used in context: Lens, compound: A lens composed of two or more separate pieces of glass or other optical material. These component pieces or elements may or may not be cemented together. A common form of compound lens is a two-element objective, one element being a converging lens of crowned glass and the other a diverging lens of flint glass. Medical Dictionary Search Engine, http://www.books.md/index.html.

A dispersive optical element as disclosed and claimed in this application is a one-piece simple component. For example, the wedge shown in FIG. 3 is a flat, polished piece of optical glass. To refer to the four reflectors in the reference as an element is incorrect. The reference never refers to these four reflectors as an element. Furthermore, these four reflective elements are not a dispersive element since this set of elements does not provide dispersion.

The reference discloses dichroic mirrors. Each dichroic mirror divides a light beam into two distinct colors (di=two, chroma=color). By using multiple mirrors in series the reference makes the image divide into three distinct color images, red, green and blue. In fact, the mirrors, being partial reflectors, will also produce a series of ghost images from multiple reflections. In this way the red image is separated from the green image and both are separated from the blue image. A white image point will therefore become three points, one red, one green and one blue.

In accordance with the invention disclosed and claimed in this application, Applicant passes the image rays through a dispersive element (the wedge prism in FIG. 3) so that a white point becomes a line segment with colors dispersed all along the segment in proportion to their wavelength. It is a continuous line looking like a rainbow.

The reference discloses a fold in the optical path. Folded systems are inherently limited in angle. Wide angle cones cannot be folded. The reference separates colors laterally but also (and by an equal amount) separates them into planes of focus. Red would focus before green and green before blue by the same amount that they are shifted laterally. This arrangement means that all colors can no longer be focused on the plane of a CCD. The reference introduces unwanted secondary reflections. These reflections produce defocused ghost images that will degrade the sharpness and resolution.

In contrast, the invention disclosed and claimed in claim 1 and the claims dependent thereon is an in-line device allowing wide angle optical paths, preserves the one plane of focus for all colors and produces no intentional reflections and may be antireflection coated to be free from ghost images. The invention of claim 1 calls for a single optical element that is far easier to produce and use than the four-mirror elements disclosed in the reference.

Claims 2-6 are dependent upon and include all the limitations of claim 1, and the reasoning in support of claim 1 is submitted to support the patentability of claims 2-6 so that further discussion of these claims is submitted to be unnecessary. Furthermore, with respect to claim 4, the Examiner incorrectly states that the four dichroic mirror elements 72, 74, 76 and 78 and the lens 10 shown in FIG. 13 are configured to focus a line image of an optical point. The four dichroic mirrors will not create a line image. They will produce three points from one point. These points will also be corrupted by the ghosts and focus errors discussed above.

Both claims 8 and 9 are restricted to the method of optical processing including focusing the image of an object upon a photoelectric array with a spectrally dispersive element between the lens and array. We have shown above that the reference does not disclose a spectrally dispersive element; therefore, it cannot and does not disclose focusing the image of an object upon a photoelectric array with a spectrally dispersive element between the lens and array.

II. AT LEAST CLAIM 4 IS SEPARATELY PATENTABLE BECAUSE CLAIM 4 CALLS FOR FOCUSING A LINE IMAGE OF AN OPTICAL POINT, AND THE REFERENCE FAILS TO DISCLOSE THIS FEATURE OR SUGGEST THE DESIRABILITY OF MODIFYING WHAT IS THERE DISCLOSED TO MEET IT.

"The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification." *In re Gordon*, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984).

The final rejection states:

> 4. Referring to claim 4, Langworthy discloses color-sensitive pixels arranged in continuous groups having a red pixel and a blue pixel as shown in figure 14. The spectrally dispersive element 72, 74, 76, and 78, and the lens 10 shown in figure 13 are configured to focus a line image of an optical point by optically

shifting object light upon a line of a group with the red end of the line within the red pixel and the blue end of the line within the blue pixel (Col. 6, Lines 6-34). P. 3.

Col. 6, lines 6-34 reads as follows:

> FIG. 13 shows a color apparatus having a solid state image sensing device 20 with a checkerboard type color filter array 22 registered thereon. A portion of the color filter array 22 is shown in FIG. 14. As seen from FIG. 14, the colors of the filter elements in the array alternate in two dimensions, vertically and horizontally. The optical device shifts the red color component of the image with respect to the green component in a vertical direction by one image sensing element, and shifts the blue component of the image with respect to the red and green components in a horizontal direction by one image sensing element. The effect is to displace the red and blue image sensing elements as shown by the arrows in FIG. 14.
>
> To accomplish the color component spatial shifts in two dimensions, a first dichroic mirror 72 positioned at an angle to the optical path, reflects red and green light and passes blue light. A mirror 74 parallel to and spaced from the dichroic mirror 72 reflects the blue light and shifts the blue component of the image with respect to the red and green components. A second dichroic mirror 76 positioned at an angle to the optical path and rotated 90° from the first set of mirrors, reflects red light and passes blue and green light. A mirror 78 parallel to and spaced from the dichroic mirror 76 reflects the blue and green light passed by dichroic mirror 76 to effect a displacement between the red component of the mage and the green and blue components.

Four dichroic mirrors will not create a line image. They will produce three points from one point. FIG. 13 of the reference clearly shows these three points labeled R, G, B, on image sensor 20. These points will also be corrupted by ghosts and focus errors because the reference introduces unwanted secondary reflections. These reflections produce the focused ghost images that will degrade the sharpness and resolution.

CONCLUSION

In view of the foregoing authorities, reasoning and the inability of the reference to anticipate the rejected claims, the decision of the Examiner finally rejecting claims 1-6, 8 and 9 as anticipated by the reference should be reversed. Should the Board believe that a claim may be

allowed in amended form, the Board is respectfully requested to include an explicit statement that such claim may be allowed in amended form, and direct that Appellant shall have the right to amend in conformity with such statement in the absence of new references or grounds of rejection.

The brief fee of $165 is enclosed. Please apply any other charges or credits to Deposit Account No. 06-1050, Order No. 13076-002001.

Respectfully submitted,

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(9) APPENDIX

Rejected Claims

1. Electro-optical apparatus comprising,

lens apparatus,

a CCD image sensor having a predetermined filter pattern of color-sensitive pixels,

and a spectrally dispersive element between said lens apparatus and said CCD.

2. Electro-optical apparatus in accordance with claim 1 wherein said filter pattern is a Bayer filter pattern.

3. Electro-optical apparatus in accordance with claim 1 wherein said filter pattern is a tri-stripe filter pattern.

4. Electro-optical apparatus in accordance with claim 2 wherein color-sensitive pixels are arranged in contiguous groups with each group having at least a red pixel and a blue pixel and said spectrally dispersive element and said lens apparatus are constructed and arranged to focus a line image of an optical point upon a line of a group with the red end of the line within the red pixel of a group and the blue end of the line within the blue pixel of the group.

5. Electro-optical apparatus in accordance with claim 4 wherein each group comprises a square having a red pixel adjacent to first and second green pixels adjacent to a blue pixel.

6. Electro-optical apparatus in accordance with claim 1 wherein said lens apparatus and said spectrally dispersive element are constructed and arranged so that red and blue images are optically shifted to coincide geometrically at a point on said CCD image sensor.

8. A method of optical processing including, focusing the image of an object upon a photoelectric array with a spectrally dispersive element between the lens and array.

9. A method of optical processing in accordance with claim 8 and further including optically shifting red and blue digital images of the object to coincide geometrically on the array.

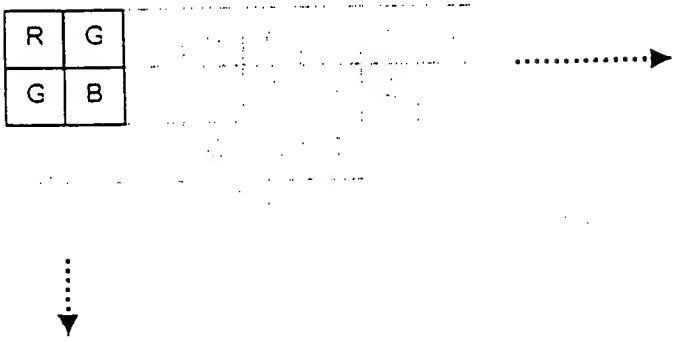

Figure 1. Bayer Filter Pattern on CCD

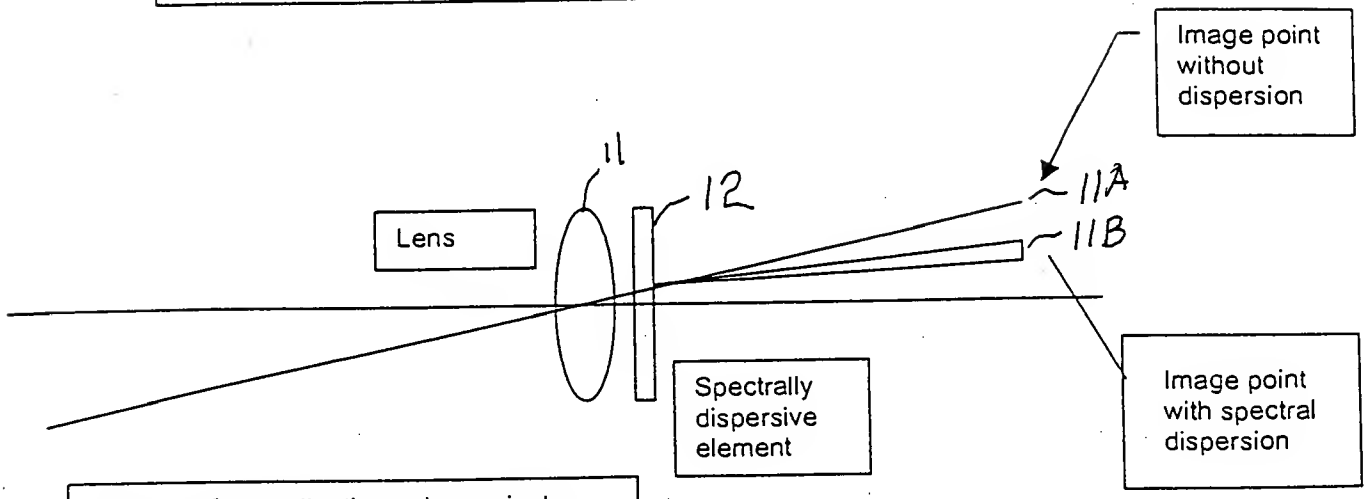

Figure 2. Spectrally dispersing a single white image point using an optical element

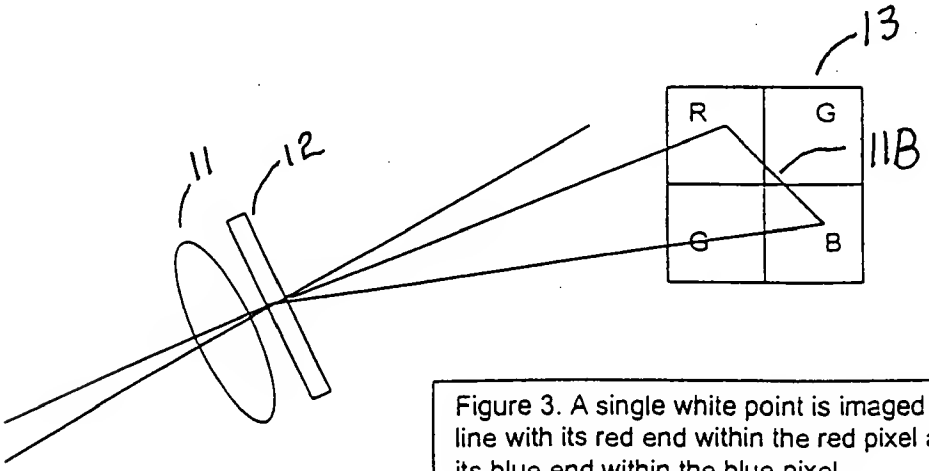

Figure 3. A single white point is imaged as a line with its red end within the red pixel and its blue end within the blue pixel.

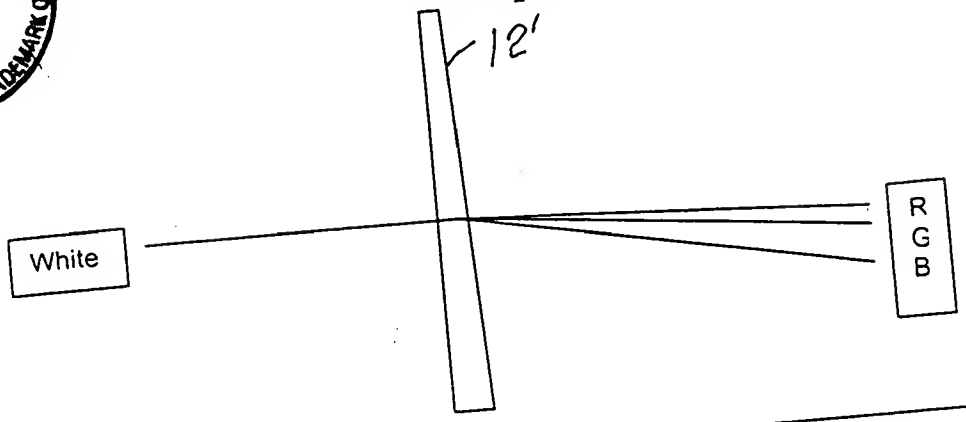

Figure 4. Spectral dispersion property of a Plane Non-parallel Plate or "Optical Wedge".

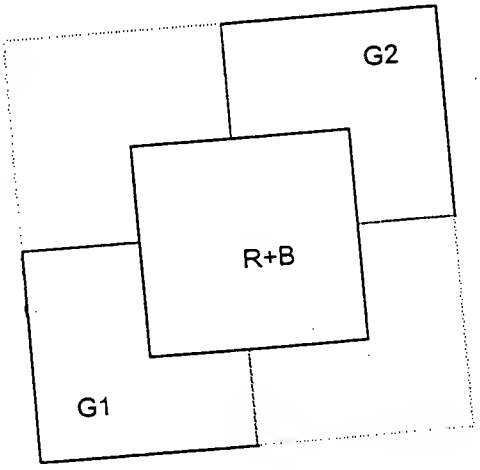

Figure 5. Effective location and color of recorded pixels using dispersive element and Bayer pattern CCD.

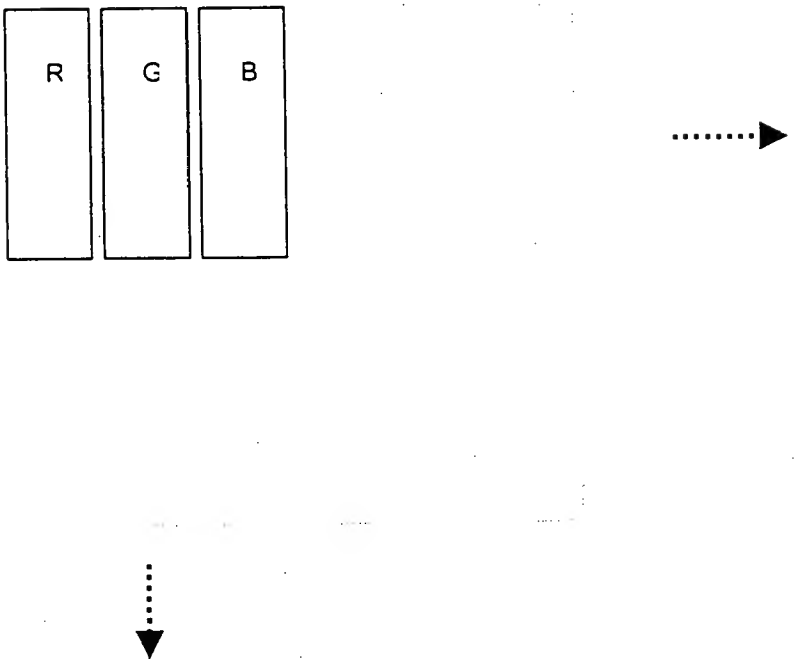

Figure 6. Optimum Tri-stripe Filter Pattern.

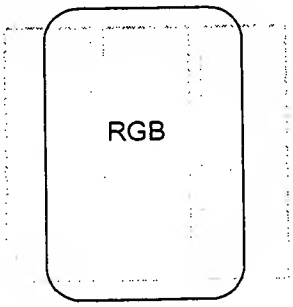

Figure 7. Effective location and color of recorded pixels using dispersive element and Optimum pattern CCD. Includes Optical image smear effect in direction of dispersion.